

What Is Claimed Is:

1 1. A method that facilitates establishing a quorum for a cluster within
2 a plurality of computers that are geographically distributed, the method
3 comprising:
4 detecting a change in membership of the cluster at a computer within the
5 plurality of computers; and
6 upon detecting the change in membership,
7 forming a potential new cluster by attempting to
8 communicate with all other computers within the plurality of
9 computers,
10 accumulating votes for each computer successfully
11 contacted,
12 attempting to gain control of a quorum server located at a
13 site separate from all computers within the plurality of computers,
14 if successful, accumulating the quorum server's votes, and
15 if a total of accumulated votes includes a majority of
16 available votes, forming a new cluster from the potential new
17 cluster.

1 2. The method of claim 1, wherein detecting the change in
2 membership involves:
3 exchanging heartbeat messages with all computers that are part of the
4 cluster; and
5 upon discovering an absence of heartbeat messages from any computer in
6 the cluster, initiating a cluster membership protocol.

1 3. The method of claim 1, wherein detecting the change in cluster
2 membership includes detecting that the cluster has not been formed.

1 4. The method of claim 1, wherein attempting to gain control of the
2 quorum server involves communicating with the quorum server using
3 cryptographic techniques.

1 5. The method of claim 1, further comprising:
2 exchanging a status message with each member of the new cluster; and
3 updating a local status at the computer to a most recent status available
4 within the status message.

1 6. A method that facilitates establishing a quorum for a cluster within
2 a plurality of computers that are geographically distributed, the method
3 comprising:
4 providing a quorum server at a site separate from a location of a computer
5 within the plurality of computers;
6 assigning at least one vote to each computer within the plurality of
7 computers;
8 assigning at least one vote to the quorum server;
9 attempting to establish communications between each pair of computers
10 within the plurality of computers;
11 accumulating a count of votes for each computer communicated with at
12 each computer;
13 attempting to establish control over the quorum server from each computer
14 within the plurality of computers;

15 if control is established over the quorum server, accumulating the quorum
16 server's votes in the count of votes; and
17 establishing the quorum when a majority of available votes has been
18 accumulated in the count of votes.

1 7. The method of claim 6, wherein the quorum server grants control
2 to only a first computer attempting to establish control.

1 8. The method of claim 6, wherein the quorum server grants control
2 to only one computer of all computers attempting to establish control based on a
3 pre-established priority list.

1 9. The method of claim 6, wherein votes are assigned so that the
2 quorum includes at least one computer that was in an immediately previous
3 cluster, to ensure that a cluster formed from the quorum has current data.

1 10. The method of claim 6, wherein attempting to establish control
2 over the quorum server involves establishing communications with the quorum
3 server.

1 11. The method of claim 10, wherein establishing communications
2 with the quorum server involves using cryptographic techniques.

1 12. A computer-readable storage medium storing instructions that
2 when executed by a computer cause the computer to perform a method that
3 facilitates establishing a quorum for a cluster within a plurality of computers that
4 are geographically distributed, the method comprising:

1 detecting a change in membership of the cluster at a computer within the
2 plurality of computers; and
3 upon detecting the change in membership,
4 forming a potential new cluster by attempting to
5 communicate with all other computers within the plurality of
6 computers,
7 accumulating votes for each computer successfully
8 contacted,
9 attempting to gain control of a quorum server located at a
10 site separate from all computers within the plurality of computers,
11 if successful, accumulating the quorum server's votes, and
12 if a total of accumulated votes includes a majority of
13 available votes, forming a new cluster from the potential new
14 cluster.

1 13. The computer-readable storage medium of claim 12, wherein
2 detecting the change in membership involves:
3 exchanging heartbeat messages with all computers that are part of the
4 cluster; and
5 upon discovering an absence of heartbeat messages from any computer in
6 the cluster, initiating a cluster membership protocol.

1 14. The computer-readable storage medium of claim 12, wherein
2 detecting the change in cluster membership includes detecting that the cluster has
3 not been formed.

1 15. The computer-readable storage medium of claim 12, wherein
2 attempting to gain control of the quorum server involves communicating with the
3 quorum server using cryptographic techniques.

1 16. The computer-readable storage medium of claim 12, the method
2 further comprising:
3 exchanging a status message with each member of the new cluster; and
4 updating a local status at the computer to a most recent status available
5 within the status message.

1 17. A computer-readable storage medium storing instructions that
2 when executed by a computer cause the computer to perform a method that
3 facilitates establishing a quorum for a cluster within a plurality of computers that
4 are geographically distributed, the method comprising:
5 providing a quorum server at a site separate from a location of a computer
6 within the plurality of computers;
7 assigning at least one vote to each computer within the plurality of
8 computers;
9 assigning at least one vote to the quorum server;
10 attempting to establish communications between each pair of computers
11 within the plurality of computers;
12 accumulating a count of votes for each computer communicated with at
13 each computer;
14 attempting to establish control over the quorum server from each computer
15 within the plurality of computers;
16 if control is established over the quorum server, accumulating the quorum
17 server's votes in the count of votes; and

18 establishing the quorum when a majority of available votes has been
19 accumulated in the count of votes.

1 18. The computer-readable storage medium of claim 17, wherein the
2 quorum server grants control to only a first computer attempting to establish
3 control.

1 19. The computer-readable storage medium of claim 17, wherein the
2 quorum server grants control to only one computer of all computers attempting to
3 establish control based on a pre-established priority list.

1 20. The computer-readable storage medium of claim 17, wherein votes
2 are assigned so that the quorum includes at least one computer that was in an
3 immediately previous cluster, to ensure that a cluster formed from the quorum has
4 current data.

1 21. The computer-readable storage medium of claim 17, wherein
2 attempting to establish control over the quorum server involves establishing
3 communications with the quorum server.

1 22. The computer-readable storage medium of claim 21, wherein
2 establishing communications with the quorum server involves using cryptographic
3 techniques.

1 23. A system that facilitates establishing a quorum for a cluster within
2 a plurality of computers that are geographically distributed, comprising:
3 the plurality of computers;

4 a network coupling the plurality of computers;
5 a quorum server located at a site separate from any one computer of the
6 plurality of computers; and
7 an independent communications link coupling each computer of the
8 plurality of computers and the quorum server.

1 24. The system of claim 23, wherein the quorum server includes a
2 mechanism for granting control to only one computer of the plurality of computers
3 requesting control.

1 25. The system of claim 23, wherein the quorum server includes a
2 mechanism for maintaining a list of computers accepted into the cluster.

1 26. The system of claim 23, wherein the quorum server includes a
2 mechanism for cryptographically ensuring an identity of a computer attempting to
3 establish control.

1 27. The system of claim 23, wherein the quorum server includes
2 monitoring means to monitor the status of each computer within the plurality of
3 computers.